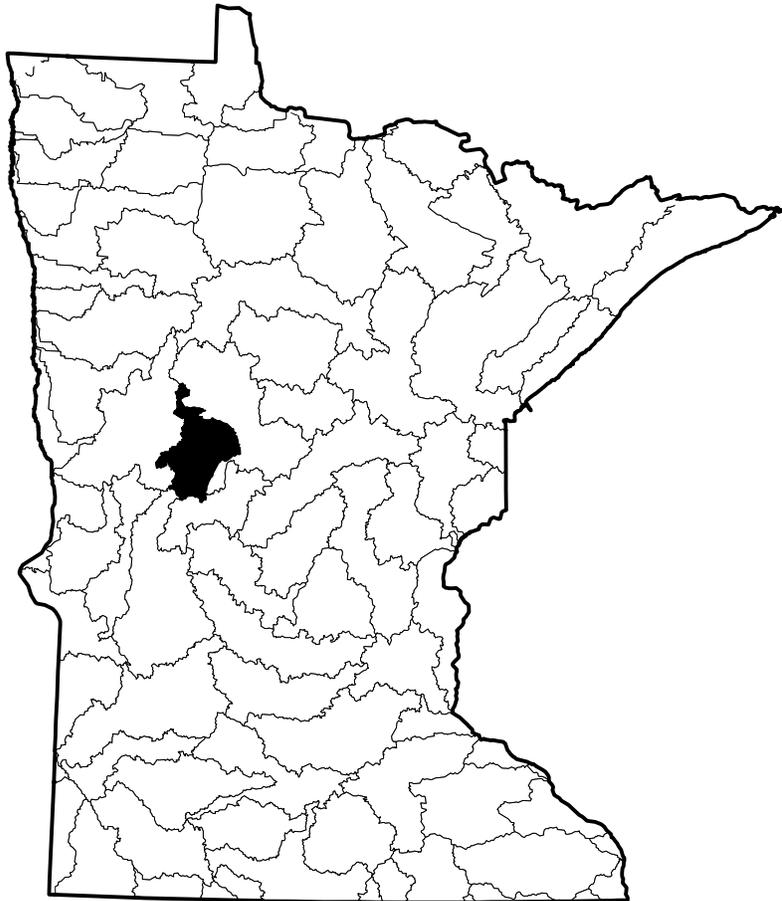




PHYSICAL CHARACTERISTICS OF STREAM SUBBASINS IN THE REDEYE (LEAF) RIVER BASIN, CENTRAL MINNESOTA

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Open -File Report 00-234



Prepared in cooperation with the
Minnesota Department of Transportation

Mounds View, Minnesota
2000

**U.S. Department of the Interior
U.S. Geological Survey**

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By Christopher A. Sanocki and Brian C. Fischer

Abstract

Data that describe the physical characteristics of stream subbasins upstream from selected sites on streams in the Redeye (Leaf) River Basin, located in central Minnesota, are presented in this report. The physical characteristics are the drainage area of the subbasin, the percentage area of the subbasin covered only by lakes, the percentage area of the subbasin covered by both lakes and wetlands, the main-channel length, and the main-channel slope. Stream sites include outlets of subbasins of at least 5 square miles, and locations of U.S. Geological Survey high-flow, and continuous-record gaging stations.

Introduction

This report is part of a series detailing subbasin characteristics of streams in Minnesota and adjacent (Leaf) River Basin drains and area of 899 square miles and is represented by hydrological accounting unit 07010107 (U.S. Geological Survey, 1974). The Redeye (Leaf) River Basin includes parts of Otter Tail, Douglas, Todd, Becker, and Wadena Counties in central Minnesota.

Selected data for sites on streams at outlets of subbasins larger than about 5 square miles; at locations of U.S. Geological Survey (USGS) high-flow, and continuous-record gaging stations located in the Redeye (Leaf) River Basin are presented in this report. This report was prepared in cooperation with the Minnesota Department of Transportation.

Acknowledgments

Scott Bryant a graduate student of St. Cloud State University, did much of the digitizing and assisted in the preparation of this report. These contributions were essential for the completion of this report.

Methods

USGS 7-1/2 minute series topographic maps were used as source maps to define subbasin boundaries and to obtain main-channel length, and contour elevation points used in this report. Paper copies of the maps were used. Lake and marsh data were obtained from U.S. Fish and Wildlife Service National Wetlands Inventory Data (U.S. Fish & Wildlife Service, 1981-present). A geographic information system (GIS) was used to define the

geographic location and extent of the subbasins, lakes, marshes, main-channels, and elevation points. Data digitized from paper copies were in error by no more than twice the horizontal accuracy of National Mapping Standards of 40 feet (Thompson, 1987, p. 104). All thematic (digitized) data were projected into an Albers Equal-Area projection for storage and analysis.

Subbasin boundaries were delineated on the basis of anthropogenic activities and topographic contours. Anthropogenic activities, such as the installation of storm sewers, the drainage of wetlands, and the diversion of streams, may alter the drainage area of a stream; therefore data from field inspections and recent drainage-ditch maps, were transferred to the topographic maps. The subbasin boundaries were digitized by the Minnesota Department of Natural Resources (DNR), and the USGS Minnesota District using a GIS.

Lake and marsh boundaries were overlaid on the subbasin boundaries to associate each lake and marsh with a subbasin. The total area of lakes and marshes within each subbasin was calculated by the GIS. Total marsh area plus total lake area is defined as storage area.

Main channels were delineated for each subbasin on the 7-1/2 minute topographic maps starting at the outflow of the subbasin and continuing upstream. Whenever the main channel joined with another stream, the stream upstream of the junction that drained the largest area was selected as the main channel. The main channel, which represents the watercourse that drains the greatest area, is continuous and is defined as a single trace that passes through marshes, lakes, and midline of rivers and braided streams from the basin outlet to an endpoint in the basin, generally at the basin divide. The main channels were

digitized by the Minnesota Department of Transportation, using a computer aided drafting system and transferred to the GIS. Stream extensions that represent a portion of the main channel from the end of the mapped stream (blue line on 7-1/2 minute topographic maps) to an endpoint within the basin, generally at the basin divide, were digitized by USGS Minnesota District using a GIS. The main-channel data were overlaid onto the subbasin data to associate each main channel with its subbasin.

Elevation points were digitized at the intersection of topographic contour lines and main channel. The elevation data were digitized using a GIS. The elevation data was overlaid onto the main channel data to associate each elevation data point with a main channel. Two points on the main-channel, at 10 percent and at 85 percent of the main channel length from the basin outlet to the drainage divide, were located by the GIS. The elevations of these two points were interpolated from the digitized elevation data. Main-channel slope was calculated by dividing the difference in elevation between these points by the distance along the stream channel between these points.

Physical Characteristics of Redeye (Leaf) River Subbasins

Physical characteristics determined for each of the subbasins shown on plate 1 are presented in table 1. Subbasins are presented in order from headwaters to mouth. The rank of the subbasin stream is shown by indentation; whenever two subbasin streams joined, the stream draining the least cumulative area was assigned a lower rank and indented in the table.

The data for drainage area, and main-channel length are reported using three significant figures or rounded to the nearest one-hundredth of a unit. The data for lake area and storage area are reported to the nearest one-tenth of a percent. The data for main-channel slope is reported to the nearest one-tenth of a foot per mile.

The following is an explanation of the terms used in table 1 and plate 1:

Subbasin number. A seven digit number based on the Minnesota Common Stream and Watershed Numbering System (Minnesota Department of Natural Resources, 1981). The first two digits are "13" and identify the Redeye (Leaf) River Basin. The following three digits are arbitrary and were assigned by the DNR. The last two digits were added by the USGS Minnesota District, to identify additional subdivisions to the DNR's watersheds at locations of USGS gaging stations and to identify noncontributing areas.

Stream name. The name of the stream or ditch shown on 7-1/2 minute topographic maps. The relative position

of the subbasin above other subbasins, streams, and gaging stations.

Outlet location. The U.S. Public Lands Survey System is used to describe the location where the stream exits the subbasin, down to quarter-quarter section. The description includes quarter-quarter section, section, township, and range.

Drainage area. That area, measured on a horizontal plane, enclosed by a topographic divide, within which direct surface runoff from precipitation normally flows by gravity into a watercourse above a specific point. This may include closed basins and other areas that do not contribute directly to surface runoff.

Lake area. The percentage of the drainage area labeled lacustrine (lakes) on U.S. Fish and Wildlife Service National Wetlands Inventory Data.

Storage area. The percentage of a drainage area labeled lacustrine (lakes) and palustrine (wetlands) on U.S. Fish and Wildlife Service National Wetlands Inventory Data. Marsh areas shown on plate 1 are from USGS 1:100,000 digital line graph data 1993.

Main-channel length. The total length of the main channel from the basin outlet to a point within the basin (generally at the basin divide) representing the watercourse that drains the greatest area.

Main-channel slope. The average slope of the watercourse between the points at 10 and at 85 percent of the distance along the main channel from the basin outlet to the drainage divide.

Stream extension. A representation of the main channel from the end of the mapped stream line (blue line on 7-1/2 minute topographic maps) to an endpoint within the basin, generally at the basin divide. This is done by interpreting topographic relief so that the extension of the main channel represents the watercourse draining the greatest area.

References Cited

- Minnesota Department of Natural Resources, 1981, The common stream and watershed numbering system: Minnesota Department of Natural Resources Stream Inventory and Data Retrieval Systems Report 7002, unpagged.
- Thompson, M.M., 1987, Maps for America, 3d edition: U.S. Geological Survey, 265 p.
- U.S. Geological Survey, 1974, Hydrologic unit map—1974 State of Minnesota: 1 plate, scale 1:500,000.
- U.S. Fish & Wildlife Service, National Wetlands Inventory Digital Data: Oct. 1981 to present.

Table 1.—Physical characteristic data for the Redeye River Basins—Continued

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Township	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
1302000	South Bluff Creek to Leaf River	SW NE	05	134N	36W	8.38	0.0	10.1	46.6	0.2	24.6	22.5	5.7
1302602	Leaf River above Bluff Creek	NW SE	33	135N	36W	1.12	0.0	28.4	222.	1.7	22.9	34.4	5.2
1303200	Blue Creek to Bluff Creek	NW SE	12	135N	37W	24.3	0.0	32.1	24.3	0.0	32.1	9.30	4.2
1303400	Bluff Creek above Blue Creek	NW SE	12	135N	37W	23.2	0.0	27.2	23.2	0.0	27.2	12.2	7.4
1302902	Bluff Creek above unnamed tributary (basin 1303500)	NE SW	13	135N	37W	4.72	0.0	20.0	52.1	0.0	28.8	10.8	5.0
1303500	Unnamed tributary to Bluff Creek	NE SW	13	135N	37W	13.0	0.4	14.6	13.0	0.4	14.6	6.65	10.6
1302901	Bluff Creek above unnamed tributary (basin 1303000)	NW NW	33	135N	36W	7.52	0.0	18.7	72.6	0.1	25.2	4.13	16.8
1303000	Unnamed tributary to Bluff Creek	NW NW	33	135N	36W	5.88	0.0	14.7	5.88	0.0	14.7	4.13	16.8
1302900	Bluff Creek to Leaf River	NW SE	33	135N	36W	0.19	0.0	21.1	78.7	0.1	24.5	16.9	6.9
1302601	Leaf River above Oak Creek	SW SE	27	135N	36W	2.04	0.0	21.6	303.	1.2	23.3	34.4	5.2
1300900	Oak Creek above unnamed tributary (basin 1304300)	SE NE	35	134N	36W	22.9	0.0	31.7	22.9	0.0	31.7	14.5	4.3
1304300	Unamed tributary to Oak Creek	SE NE	35	134N	36W	8.77	0.0	38.7	8.77	0.0	38.7	18.6	4.2
1302300	Oak Creek to Leaf River	NW NE	34	135N	36W	6.59	0.0	15.1	38.2	0.0	30.4	24.3	4.4
1303100	Unnamed tributary to Leaf River	NE NW	36	135N	36W	19.4	0.0	23.3	19.4	0.0	23.3	12.6	11.0
1302600	Leaf River above unnamed tributary (basin 1302400)	NW SW	30	135N	35W	2.28	0.0	44.8	363.	1.0	24.2	37.5	4.8
1302400	Unnamed tributary to Leaf River	NW SW	30	135N	35W	10.3	0.0	11.7	10.3	0.0	11.7	8.98	7.2
1302500	Leaf River above Union Creek	NW SW	27	135N	35W	14.3	0.0	23.7	387.	1.0	23.8	41.3	4.5
1301000	Whisky Creek to Union Creek	SW SE	05	134N	35W	8.80	0.0	21.8	8.80	0.0	21.8	8.88	8.4
1301101	Union Creek to above Whisky Creek	SE SW	05	134N	35W	8.67	0.0	23.4	8.67	0.0	23.4	11.0	7.2
1301100	Union Creek to Leaf River	NW SW	27	135N	35W	3.37	0.0	33.5	20.8	0.0	24.4	13.5	8.5

Table 1.—Physical characteristic data for the Redeye River Basins—Continued

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Township	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
1304601	Leaf River above unnamed tributary (basin 1304700)	SW NW	24	135N	35W	5.55	0.0	18.0	414.	0.9	23.8	44.2	4.4
1304700	Unnamed tributary to Leaf River	SW NW	24	135N	35W	7.30	0.0	25.1	7.30	0.0	25.1	8.38	16.8
1304600	Leaf River above unnamed tributary (basin 1304400)	NW SE	24	135N	35W	1.54	0.0	22.9	422.	0.9	23.8	44.6	4.3
1304400	Unnamed tributary to Leaf River	NW SE	24	135N	35W	10.7	0.0	22.9	10.7	0.0	22.9	11.0	9.3
1304501	Leaf River above unnamed tributary (basin 1305200)	NW SW	20	135N	34W	1.27	0.0	27.8	434.	0.9	23.8	47.0	4.2
1305200	Unnamed tributary to Leaf River	SW NW	20	135N	34W	4.34	0.0	7.0	4.34	0.0	7.0	3.91	36.0
1304500	Leaf River above Wing River	SE NW	28	135N	34W	11.7	0.0	13.8	450.	0.8	23.4	49.2	4.1
1300608	Noncontributing area to basin 1300600	--	--	--	--	1.15	11.2	28.9	1.15	11.2	28.9	--	--
1300609	Noncontributing area to basin 1300600	--	--	--	--	1.18	0.0	7.9	1.18	0.0	7.9	--	--
1300600	Unnamed tributary above unnamed tributary (basin 1300501)	SE NE	23	132N	37W	21.5	1.5	19.4	23.9	1.9	19.3	13.0	11.6
1300501	Unnamed tributary above unnamed tributary (basin 1300600)	SE NE	23	132N	37W	9.20	0.0	11.0	9.20	0.0	11.0	3.99	3.2
1300500	Unnamed tributary above unnamed tributary (basin 1300402)	SW NW	24	132N	37W	0.07	0.0	68.6	33.1	1.4	17.1	2.96	4.7
1300402	Unnamed tributary to Wing River	SW NW	24	132N	37W	3.00	4.1	35.9	3.00	4.1	35.9	2.96	4.7
1300401	Wing River above County Ditch 13	NW SE	27	132N	36W	14.6	0.4	37.8	50.8	1.3	24.1	21.5	3.3
1300209	Noncontributing area to basin 1300200	--	--	--	--	6.46	6.0	9.8	6.46	6.0	9.8	--	--
1300200	County Ditch 13 to Wing River	NW SE	27	132N	36W	15.7	5.0	33.9	22.1	5.3	26.9	12.2	2.9
1300400	Wing River above Annalaide Lake Ditch	SW SW	25	132N	36W	3.22	0.0	20.4	76.1	2.4	24.8	23.5	3.1
1300100	Annalaide Lake Ditch to Wing River	SW SW	25	132N	36W	23.7	3.6	31.2	23.7	3.6	31.2	9.05	3.7
1300300	Wing River to Leaf River	SE NW	28	135N	34W	58.0	0.3	15.7	158.	1.8	22.4	60.1	3.2

Table 1.—Physical characteristic data for the Redeye River Basins—Continued

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Township	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
1305601	Leaf River above unnamed tributary (basin 1305700)	NW NW	30	135N	33W	13.2	0.0	15.0	622.	1.1	22.9	55.7	3.8
1305700	Unnamed tributary to Leaf River	NW NW	30	135N	33W	5.98	0.0	18.1	5.98	0.0	18.1	5.05	9.8
1305600	Leaf River above Redeye River	SE SE	19	135N	33W	0.67	0.0	4.5	628.	1.0	22.9	56.6	3.8
1304200	Redeye River above unnamed tributary (basin 1303700)	NE NW	13	137N	37W	54.8	4.4	22.6	54.8	4.4	22.6	27.1	4.5
1303700	Unnamed tributary to Redeye River	NW NW	13	137N	37W	17.9	3.4	29.3	17.9	3.4	29.3	10.2	4.2
1303900	Redeye River above Cat Creek	NE SE	17	137N	36W	7.81	0.0	15.9	80.6	3.8	23.4	32.0	4.2
1304000	Cat Creek to Redeye River	NW SW	16	137N	36W	9.99	0.0	23.0	9.99	0.0	23.0	6.35	12.5
1303800	Redeye River above Hay Creek	SW NE	33	137N	35W	18.8	0.0	16.2	109.	2.8	22.1	44.4	4.0
1303600	Hay Creek to Redeye River	SE NW	33	137N	35W	21.6	0.0	27.7	21.6	0.0	27.7	13.2	5.0
1305001	Redeye River above unnamed tributary (basin 1305300)	NW SW	12	135N	34W	45.7	0.0	23.4	177.	1.7	23.2	67.2	3.9
1305300	Unnamed tributary to Redeye River	NW SW	12	135N	34W	9.44	0.0	31.6	9.44	0.0	31.6	7.39	6.1
1305000	Redeye River above Hay Creek	NW SE	13	135N	34W	0.59	0.0	39.3	187.	1.6	23.6	69.6	3.9
1304900	Hay Creek above unnamed tributary (basin 1304800)	SE NE	25	136N	35W	8.28	0.0	20.0	8.28	0.0	20.0	9.79	12.6
1304800	Unnamed tributary to Hay Creek	SE NE	25	136N	35W	5.86	0.0	19.3	5.86	0.0	19.3	4.79	19.4
1305100	Hay Creek to Redeye River	NE SW	13	135N	34W	15.1	0.0	26.5	29.2	0.0	23.2	21.8	6.8
1305500	Redeye River above Leaf River	SE SE	19	135N	33W	6.04	0.0	29.1	222.	1.4	23.7	73.0	3.9
1305803	Leaf River above unnamed tributary (basin 1305400)	SE SW	21	135N	33W	0.81	0.0	15.2	851.	1.1	23.1	58.3	3.7
1305400	Unnamed tributary to Leaf River	SE SW	21	135N	33W	8.17	0.0	35.8	8.17	0.0	35.8	5.26	11.7

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
1305802	Leaf River at gaging station near Aldrich: Station number is 05244440	SW SW	34	135N	33W	7.57	0.0	16.6	867.	1.1	23.2	61.5	3.7
1305801	Leaf River above unnamed tributary	SW NW	11	134N	33W	3.21	0.0	22.6	870.	1.1	23.2	64.3	3.6
1305900	Unnamed tributary to Leaf River	SW NW	11	134N	33W	29.0	0.0	22.2	29.0	0.0	22.2	21.9	7.9
1305800	Leaf River to Crow Wing River	SW SW	11	134N	33W	0.20	0.0	16.5	899.	1.1	23.1	64.8	3.6

